

WHAT IS CLAIMED IS:

- 1 1. A field portable mass spectrometer system comprising:
 - 2 a) a sample collector;
 - 3 b) a sample transporter, the sample transporter interfacing with the sample
 - 4 collector to receive sample deposits thereon;
 - 5 c) a time of flight (TOF) mass spectrometer, the time of flight mass spectrometer
 - 6 having a sealable opening that receives the sample transported via the sample transporter in an
 - 7 extraction region of the mass spectrometer; and
 - 8 d) a control unit that processes a time series output by the mass spectrometer for a
 - 9 received sample and identifies one or more agents contained in the sample.
- 1 2. The field portable mass spectrometer system of Claim 1, wherein the sample
- 2 collector comprises an inlet having a vacuum therein, the inlet collecting an environmental
- 3 specimen via the vacuum.
- 1 3. The field portable mass spectrometer system of Claim 2, wherein the sample
- 2 collector further comprises one or more impactors that removes at least one particulate sample
- 3 from the environmental specimen and deposits it on a transport medium of the sample
- 4 transport.
- 1 4. The field portable mass spectrometer system of Claim 1, wherein the sample
- 2 transporter comprises a tape that receives the sample deposits from the sample collector, the

3 tape being received at the sealable opening of the mass spectrometer, thereby allowing a
4 sample thereon to be received in the extraction region of the mass spectrometer.

1 5. The field portable mass spectrometer system of Claim 4, wherein movement of
2 the tape when interfacing with the sample collector is independent of movement of the tape
3 when being received in the mass spectrometer.

1 6. The field portable mass spectrometer system of Claim 5, wherein the sample
2 transporter further comprises a first stepper motor that receives control signals from the
3 control unit and enables independent movement of the tape when interfacing with the sample
4 collector and a second stepper motor that receives control signals from the control unit and
5 enables independent movement of the tape when being received in the mass spectrometer.

1 7. The field portable mass spectrometer system of Claim 5, wherein the
2 independent movement of the tape is provided at least in part by a movable tensioner that
3 interfaces with the tape, the movable tensioner being interposed between the sample collector
4 and the mass spectrometer.

1 8. The field portable mass spectrometer system of Claim 7, wherein the tensioner
2 is a spring-loaded roller, the tape being wound around at least a part of the roller.

1 9. The field portable mass spectrometer system of Claim 1, wherein the TOF
2 mass spectrometer comprises a reflectron TOF mass spectrometer.

1 10. The field portable mass spectrometer system of Claim 1, wherein the sealable
2 opening and the extraction region of the TOF mass spectrometer are provided in a housing of
3 the TOF mass spectrometer.

1 11. The field portable mass spectrometer system of Claim 10, wherein the housing
2 further comprises a roughing vacuum chamber portion that extends from the sealable opening
3 of the housing to a vacuum valve.

1 12. The field portable mass spectrometer system of Claim 11, wherein the housing
2 further comprises a removable cover that is engageable with the sealable opening, the
3 removable cover and the sealable opening forming a vacuum seal when engaged.

1 13. The field portable mass spectrometer system of Claim 12, wherein a roughing
2 pump interfaces with the roughing vacuum chamber portion and serves to evacuate the
3 roughing vacuum chamber portion when (a) the vacuum seal is formed between the
4 removable cover and the sealable opening and (b) the vacuum valve is closed.

1 14. The field portable mass spectrometer system of Claim 12, wherein the vacuum
2 seal is provided by at least one o-ring in each of the removable cover and the sealable

3 opening, the o-rings engaging to form a vacuum seal when the removable cover engages the
4 sealable opening.

1 15. The field portable mass spectrometer system of Claim 14, wherein the cover is
2 a platen.

1 16. The field portable mass spectrometer system of Claim 12, wherein a surface of
2 the cover that covers the sealable opening comprises an electrode and defines one end of an
3 extraction region of the TOF mass spectrometer in the roughing vacuum chamber portion.

1 17. The field portable mass spectrometer system of Claim 16, wherein a second
2 electrode surrounding the roughing vacuum chamber portion and lying between the sealable
3 opening and the vacuum valve defines another end of the extraction region.

1 18. The field portable mass spectrometer system of Claim 17, wherein the drift
2 region of the TOF mass spectrometer comprises the portion of the roughing vacuum chamber
3 portion between the second electrode and the vacuum valve.

1 19. The field portable mass spectrometer system of Claim 18, wherein the drift
2 region of the TOF mass spectrometer extends through the vacuum valve and into a main mass
3 spectrometer vacuum chamber.

1 20. The field portable mass spectrometer system of Claim 19, wherein a vacuum
2 pump that interfaces with the main mass spectrometer vacuum chamber serves to evacuate the
3 main mass spectrometer vacuum chamber.

1 21. The field portable mass spectrometer system of Claim 20, wherein the vacuum
2 pump that interfaces with the main mass spectrometer vacuum chamber serves to evacuate the
3 main mass spectrometer vacuum chamber and the roughing vacuum chamber when the valve
4 is opened, thereby providing a connected vacuum between the main mass spectrometer
5 vacuum chamber and the roughing vacuum chamber when the valve is opened.

1 22. The field portable mass spectrometer system of Claim 11, wherein the TOF
2 mass spectrometer comprises an ionizing laser, the housing further comprises a laser light port
3 that provides entrance for ionizing laser light from the laser into the housing and the roughing
4 vacuum chamber portion in the housing having a vacuum sealed transparent port that provides
5 entrance for the ionizing laser light that enters the housing into the roughing vacuum chamber
6 portion so that it is incident on the plane of the opening.

1 23. The field portable mass spectrometer system of Claim 11, wherein the TOF
2 mass spectrometer comprises a linear TOF mass spectrometer and a reflectron TOF mass
3 spectrometer.

1 24. The field portable mass spectrometer system of Claim 11, wherein the TOF
2 mass spectrometer comprises a nonlinear reflectron TOF mass spectrometer.

1 25. The field portable mass spectrometer system of Claim 24, wherein the electric
2 field in the nonlinear reflectron is substantially determined by the equation of a circle.

1 26. The field portable mass spectrometer system of Claim 11, wherein the valve
2 interfaces with a mass spectrometer vacuum chamber comprising at least a part of a drift
3 region, a detector and a reflectron of a reflectron TOF mass spectrometer.

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27. The field portable mass spectrometer system of Claim 5, wherein the tape is
capable of being marked magnetically or optically prior to or during sample collection to
assist in locating the sample or to add sample collection-related information.

28. The field portable mass spectrometer system of Claim 27, further comprising
means for reading the magnetic or optical markings on the tape to permit precise positioning
of the sample in the extraction region of the mass spectrometer.

29. The field portable mass spectrometer system of Claim 28, further comprising
means for adding a fluid to the sample prior to the sample being received in the extraction
region.

30. The field portable mass spectrometer system of Claim 29, further comprising means for drying the fluid after the fluid is added to the sample.

31. The field portable mass spectrometer system of Claim 1, further comprising a computer-based data acquisition system.

32. The field portable mass spectrometer system of Claim 1, further comprising a graphical user interface for interfacing with the control unit.

33. The field portable mass spectrometer system of Claim 15, further comprising a means for pressurizing the extraction region, when the platen is open, with dry, filtered air to prevent the accumulation of moisture or other environmental contaminants.